(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 066 815**
B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication of patent specification: **20.11.86**

(51) Int. Cl.⁴: **B 60 K 5/12**, F 16 F 1/38

(21) Application number: **82104729.7**

(22) Date of filing: **28.05.82**

(54) Power unit mount.

(30) Priority: **03.06.81 JP 84436/81**

(43) Date of publication of application:
15.12.82 Bulletin 82/50

(45) Publication of the grant of the patent:
20.11.86 Bulletin 86/47

(84) Designated Contracting States:
DE FR GB

(56) References cited:
EP-A-0 009 120
FR-A- 817 656
FR-A- 887 123
FR-A-1 454 145
GB-A-1 570 751
GB-A-2 010 438
US-A-2 256 752
US-A-2 948 502
US-A-4 183 496

(73) Proprietor: **NISSAN MOTOR CO., LTD.**
No.2, Takara-cho, Kanagawa-ku
Yokohama-shi Kanagawa-ken 221 (JP)
(73) Proprietor: **TOKAI RUBBER INDUSTRIES, LTD.**
No. 3600, Aza Utazu Oaza Kita-toyama
Komaki-City Aichi Prefecture (JP)

(72) Inventor: **Chiba, Kazuo**
No. 2-12-14, Kamitakaido Suginami-ku
Tokyo (JP)
Inventor: **Kanda, Ryoji**
No. 20, Higashi-yashiki Haguro-shinden
Inuyama City (JP)

(74) Representative: **Patentanwälte Grünecker, Dr. Kinkeldey, Dr. Stockmair, Dr. Schumann, Jakob, Dr. Bezold, Meister, Hilgers, Dr. Meyer-Plath**
Maximilianstrasse 58
D-8000 München 22 (DE)

EP 0 066 815 B1

Courier Press, Leamington Spa, England.

Description

The present invention relates to a mount for mounting a power unit on a vehicle body according to the precharacterizing part of claim 1.

A known mount for mounting a power unit on a vehicle body is illustrated in Fig. 1 wherein an inner member 2 is mounted within an outer member 4 by means of two elastomeric arms 3 radially extending from the inner member 2 to the outer member 4. In mounting the power unit on the vehicle body, a plurality of such mounts are located between the power unit and the vehicle body. The outer member 4 is fixedly secured to the vehicle body and the inner member 2 to the power unit. The setting is made such that the two elastomeric arms lie in a horizontal plane upon application of a static load due to the weight of the power unit. The mount 1 comprises two elastomeric restraining blocks 5 for preventing an excessively large displacement of the inner member 2 relative to the outer member 4. In operation, a small vibration of the power unit in the vertical direction causes the inner member 2 to displace in the vertical direction, applying a shear stress to the elastomeric arms 3. The spring constant of the elastomeric arms 3 under shear stress is smaller than the spring constant of the elastomeric arms 3 under compression stress. An excessively large displacement in the vertical direction of the inner member 2 is prevented by abutting engagement of the inner member 2 with one of the two elastomeric restraining blocks 5.

The spring constant of the elastomeric arms 3 varies with variation in the direction of the vibration as shown by broken line curve A in Fig. 2 wherein Y-axis indicates the vertical direction and X-axis the horizontal direction. Referring to the broken line A in Fig. 2, the spring constant in the vertical direction is α (alpha) and the spring constant in a direction inclined from the vertical direction by an angle θ (theta) is a. Apparently, the spring constant in the vertical direction is minimum and the spring constant in the inclined direction is larger than the spring constant α (alpha) in the vertical direction.

It is necessary that the spring constant α (alpha) in the vertical direction be set considering the weight of the power unit and be large enough for supporting it. The spring constant in the inclined direction becomes large accordingly, failing to effectively prevent small vibrations in the inclined direction.

If, the mount 1 is arranged such that the two elastomeric arms 3 lie in a plane perpendicular to the inclined direction of vibration, the spring constant in the inclined direction reduces, thus effectively preventing the small vibration in this inclined direction. With this arrangement, however, one of the elastomeric arms 3 is subject to a tensile stress, while, the other to a compression stress. The elastomeric arm 3 which is subject to the tensile stress is liable to crack quickly as c mpared to the other elastomeric arm 3, leading to a short operating life.

A mount, according to the precharacterizing part of claim 1, is known from GB—A—1 570 751. In this specification, an anti-vibration mounting is disclosed wherein the body to be mounted is supported by symmetrically arranged anti-vibration buffers, each comprising a shaft, a hollow cylinder surrounding the shaft in spaced relation therewith and an elastic member between the interior surface of the cylinder and the exterior surface of the shaft, the buffer having an axis of high rigidity and an axis of low rigidity in a plane perpendicular to the longitudinal axis of the shaft. The buffer is mounted such that the axis of high rigidity intersects a vertical plane through the centre of gravity of the body to be mounted at a position below the intersection with the vertical plane of the axis of low rigidity. By a plurality of holes extending parallel to the longitudinal axis of the shaft, the elastic member is generally T-shaped.

It is the object of the present invention to provide a mount which has a small spring constant in an inclined direction from the vertical direction.

This object is attained by the characterizing features of claim 1. Preferred embodiments of the invention are subject matter of the subclaims.

The invention is further described in connection with the accompanying drawings, wherein:

Fig. 1 is a schematic axial end view illustrating the just described known power unit mount;

Fig. 2 shows spring constant vs., vibration incident direction curves;

Fig. 3 is a schematic cross sectional view of an embodiment of a mount according to the present invention when it is in the free state; and

Fig. 4 is a sectional view taken along the line IV—IV in Fig. 3.

Description of the Embodiment

Referring to Figs. 3 and 4, a mount generally indicated by 10 comprises an outer member in the form of a metal outer shell 12 having an axis 14 and a cylindrical inner wall 16, an inner member in the form of a metal inner tube 18 disposed within the outer member 12, and a generally T shaped elastomeric member 20 having a hub portion 22 fixedly coupled with the inner member 18, a leg portion 24 and two arm portions 26 and 28. The leg portion 24 and arm portions 26 and 28 are extending radially outwardly from the hub portion 22 and have respective ends fixedly adhered to the cylindrical inner wall 16 by a vulcanizing adhesive. The T shaped elastomeric member 20 is made of a rubber in this embodiment. In a free state as shown in Fig. 3, the leg portion 24 is not compressed and the arm portions 26 and 28 are displaced in a direction away from the leg portion 24 from a radial plane perpendicular to this direction. The T shaped elastomeric member 20 is formed with a flat surface 30 on the hub portion 22 facing and adapted to abut with an elastomeric restraining block 32 fixedly attached to the cylindrical wall 16.

During mounting a power unit on a vehicle body, a plurality of such mounts are used. The

outer member 12 is in press fit within a hole of the bracket on the vehicle body, while, the inner member 18 receives a power unit supporting bar of the power unit. It is necessary that the mount unit 10 be arranged such that the leg portion lies in the vertical plane and, under application of a static load due to the weight of the power unit, the inner member 18 which has been in the displaced position is pushed downwardly as viewed in Fig. 3 toward the center axis 14. As a result, the leg portion 24 is compressed between the inner member 18 and the outer member 12 and the arm portions 26 and 28 lie generally in the horizontal plane. Preferably, the amount of displacement of the inner member 18 from the center axis 14 and an inclined angle of each of the arm portions 26 and 28 from the horizontal plane should be set such that, upon application of the static load, the inner member 18 assumes the center position near the center axis 14 and the arm portions 26 and 28 lie in the horizontal plane.

Spaces between the cylindrical inner wall 16 and T shaped elastomeric member 20 and the elastomeric restraining block 32 receive four generally triangular shaped elastomeric blocks 34, 36, 28 and 40 which are made of a rubber. The elastomeric blocks 34, 36, 38 and 40 are fixedly adhered to the cylindrical inner wall 16 of the outer member 12 by a vulcanizing adhesive. As shown in Fig. 3, four L shaped clearance spaces 42, 44, 46 and 48 are defined between the blocks 34, T shaped member 20 and the restraining block 32.

The width 1_1 (as viewed in Fig. 3) of the upper two L shaped clearance spaces 42 and 44 is set smaller than the width 1_2 of the lower two L shaped clearance spaces 46 and 48 when the mount 10 is in the free state to such an extent that the width 1_1 becomes equal to the width 1_2 upon application of the static load.

The mount 10 shows the spring constant as shown by the solid line curve B in Fig. 2 upon application of the static load. As will be appreciated from Fig. 2, the spring constant b (see Fig. 2) which is provided by the mount 10 according to the present invention when it is subject to vibration in the direction inclined from the vertical direction by an angle θ (theta) is smaller than the spring constant a (see Fig. 2) which is provided by the known mount 1 explained in connection with Fig. 1 with the spring constant in the vertical direction kept the same as that of the known mount 1.

In the case an excessively large force is applied, the generally T shaped elastomeric member 20 comes into abutting engagement with the elastomeric blocks 34, 36, 38 and 40, thus preventing an excessive displacement of the inner member 18 relative to the outer member 12.

The arrangement wherein the width 1_1 is equal to the width 1_2 under application of the static load pr vides stabl vibrati n suppressing effect.

If desired, the arm portions 26 and 28 and leg portion 24 are preloaded radially even when the mounting unit 10 is in the free state. Even in this case the setting should be such that a space is formed between the flat surface 30 and the restraining block 32 under application of the static load. Preloading the arm portions 26 and 28 and leg portion 24 leads to a long operating life of the mount 10.

Although, in the preceding description, the inner member 18 is secured to the power unit and the outer member 12 to the vehicle body, the inner member may be secured to the bracket of the vehicle body and the outer member to the power unit supporting bar of the power unit. In the latter case, the mounting unit 10 is arranged such that the leg portion 24 extends upwardly so that the leg portion is compressed upon application of the static load due to the weight of the power unit. In other words, the mount 10 is used in a position turned upside down from the position illustrated in Fig. 3.

Claims

1. A mount (10) for mounting a power unit on a vehicle body comprising;

an outer member (12) having a cylindrical inner wall (16) with an axis (14), said outer member (12) being adapted to be fixedly secured to one of the power unit and the vehicle body;

an inner member (18) disposed within said outer member (12) and having a central axis being parallel to said axis (14) of said cylindrical inner wall, said inner member (18) being adapted to be fixedly secured to the other one of the power unit and the vehicle body; and

a generally T-shaped elastomeric member (20) having a hub portion (22) fixedly coupled with said inner member (18), a leg portion (24) extending radially outwardly and having an end fixed to the cylindrical wall (16) of said outer member (12), said T-shaped elastomeric member (20) having two arm portions (26, 28) extending outwardly from said hub portion (22) and having ends fixed to the cylindrical inner wall (16), respectively, characterized in that:

the two arms portions (26, 28) are inclined from a generally horizontal plane towards the cylindrical inner wall (16) when said leg portion (24) is disposed vertically, so that said central axis of said inner member (18) is displaced from the axis (14) of said cylindrical inner wall (16) and, upon application of a static load due to weight of the power unit, said leg portion is compressed and said arm portions assume a generally horizontal plane.

2. A mount as claimed in claim 1, further comprising an elastomeric restraining block (32) arranged to prevent an excessively large displacement of said inner member (18) relative to said outer member (12).

3. A mount as claimed in claim 2, wherein said generally T-shaped elastomeric member (20) and said elastomeric restraining block (32) cooperate with the cylindrical inner wall (16) of said outer member (12) t define spaces, and further comprising generally triangular shaped elastomeric

blocks (34, 36, 38, 40) disposed within said spaces, respectively, and fixed to the cylindrical inn r wall (16) of said outer member (12).

4. A mount as claimed in claim 3, wherein said generally T-shaped elastomeric member (20) and said elastomeric restraining block (32) cooperate with said generally triangular shaped elastomeric blocks (34, 36, 38, 40) to define L-shaped clearance spaces (42, 44, 46, 48) which have substantially equal width upon application of the static load.

5. A mount as claimed in claim 1 or 2 or 3 or 4, wherein said leg portion (24) and said arm portions (26, 28) of said generally T-shaped elastomeric member (20) are preloaded radially between said outer member (12) and said inner member (18).

Patentansprüche

1. Lager (10) zum Montieren einer Motoreinheit an einem Fahrgestell, enthaltend:

ein äußeres Element (12) mit einer zylindrischen Innenwand (16) mit einer Achse (14), wobei das äußere Element (12) dazu eingerichtet ist, fest an der Motoreinheit oder dem Fahrgestell angebracht zu werden;

ein inneres Element (18), das innerhalb des äußeren Elements (12) angeordnet ist und eine Mittenachse hat, die parallel zur genannten Achse (14) der zylindrischen Innenwand ist, wobei das innere Element (18) dazu eingerichtet ist, fest an dem Fahrgestell bzw. der Motoreinheit angebracht zu werden; und

ein im allgemeinen T-förmiges elastomeres Element (20), mit einem Nabenteil (22), der fest mit dem inneren Element (18) verbunden ist, einem Fußteil (24), der sich radial nach außen erstreckt und ein Ende aufweist, das an der zylindrischen Wand (16) des äußeren Elements (12) befestigt ist, wobei das T-förmige elastomere Element (20) zwei Armteile (26, 28) aufweist, die sich von dem Nabenteil (22) nach außen erstrecken und Enden aufweisen, die jeweils an der zylindrischen Innenwand (16) befestigt sind, dadurch gekennzeichnet, daß:

die zwei Armteile (26, 28) von einer im wesentlichen horizontalen Ebene gegen die zylindrische Innenwand (16) geneigt sind, wenn der Fußteil (24) vertikal angeordnet ist, so daß die Mittenachse des genannten inneren Elements (18) gegenüber der Achse (14) der zylindrischen Innenwand (16) versetzt ist und bei Aufbringung einer statischen Last aufgrund des Gewichts der Motoreinheit der Fußteil zusammengedrückt wird und die Armteile eine im wesentlichen horizontale Ebene einnehmen.

2. Lager nach Anspruch 1, weiterhin enthaltend einen elastomeren Halteblock (32), der dazu angeordnet ist, einen zu großen Versatz des inneren Elements (18) gegenüber dem äußeren Element (12) zu verhindern.

3. Lager nach Anspruch 2, bei dem das im wesentlichen T-förmige elastomere Element (20) und der elastomere Halteblock (32) mit der zylindrischen Innenwand (16) des äußeren Elements (12) zusammenwirken, um Zwischenräume auszubilden, und weiterhin enthaltend im wesentlichen dreieckig gestaltete elastomere Blöcke (34, 36, 38, 40), die jeweils in den genannten Zwischenräumen angeordnet sind und mit der zylindrischen Innenwand (16) des äußeren Elements (12) fest verbunden sind.

4. Lager nach Anspruch 3, bei dem das im wesentlichen T-förmige elastomere Element (20) und der elastomere Halteblock (32) mit den im wesentlichen dreieckig gestalteten elastomeren Blöcken (34, 36, 38, 40) zusammenwirken, um L-förmige Freiräume (42, 44, 46, 48) auszubilden, die im wesentlichen gleiche Breite bei Einwirkung der statischen Last haben.

5. Lager nach Anspruch 1 oder 2 oder 3 oder 4, bei dem der Fußteil (24) und die Armteile (26, 28) des im wesentlichen T-förmigen elastomeren Elements (20) radial zwischen dem äußeren Element (12) und dem inneren Element (18) vorbelastet sind.

Revendications

1. Support (10) pour monter une unité motrice sur une carrosserie de véhicule comprenant;

un organe externe (12) ayant une paroi interne cylindrique (16) avec un axe (14), ledit organe externe (12) étant adapté à être fixé solidement à l'unité motrice ou à la carrosserie du véhicule;

un organe interne (18) disposé dans ledit organe externe (12) ayant un axe central qui est parallèle audit axe (14) de ladite paroi interne cylindrique, ledit organe interne (18) étant adapté à être fixé solidement à l'autre de l'unité motrice ou de la carrosserie du véhicule; et

un organe en élastomère (20) généralement en forme de T ayant une portion de moyeu (22) reliée solidement audit organe interne (18), une portion de branche (24) s'étendant radialement vers l'extérieur et ayant une extrémité fixée à la paroi cylindrique (16) dudit organe externe (12), ledit organe en élastomère (20) en forme de T ayant deux portions de bras (26, 28) qui s'étendent vers l'extérieur de ladite portion du moyeu (22) et ayant des extrémités fixées à la paroi interne cylindrique (16) respectivement caractérisé en ce que:

les deux portions de bras (26, 28) sont inclinées par rapport à un plan généralement horizontal vers la paroi cylindrique interne (16) lorsque ladite portion de branche (24) est disposée verticalement, donc ledit axe central dudit organe interne (18) est déplacé de l'axe (14) de ladite paroi cylindrique interne (16) et lors de l'application d'une charge statique due au poids de l'unité motrice, ladite portion de branche est comprimée et lesdites portions de bras prennent un plan généralement horizontal.

2. Support selon la revendication 1 comprenant de plus un block de retenue (32) en élastomère gencé pour empêcher un déplacement excessivement important dudit organe intern (18) relativement audit rgan extern (12).

3. Support selon la revendication 2 où ledit organe en élastomère (20) généralement en forme de T et ledit block de retenue (32) en élastomère coopèrent avec la paroi cylindrique interne (16) dudit organe externe (12) pour définir des espaces et comprenant de plus des blocs en élastomère généralement de forme triangulaire (34, 36, 38, 40) disposés dans lesdits espaces respectivement et fixés à la paroi cylindrique interne (16) dudit organe externe (12).

4. Support selon la revendication 3 où ledit organe en élastomère (20) généralement en forme de T et ledit block de retenue (32) en élastomère coopèrent avec lesdits blocs en élastomère généralement de forme triangulaire (34, 36, 38, 40) pour définir des espaces de jeu en forme de L (42, 44, 46, 48) qui ont une largeur sensiblement égale lors de l'application de la charge statique.

5. Support selon la revendication 1 ou 2 ou 3 ou 4 où ladite portion de branche (24) et lesdites portions de bras (26, 28) dudit organe en élastomère (20) généralement en forme de T sont radialement préchargées entre ledit organe externe (12) et ledit organe interne (18).

FIG.1

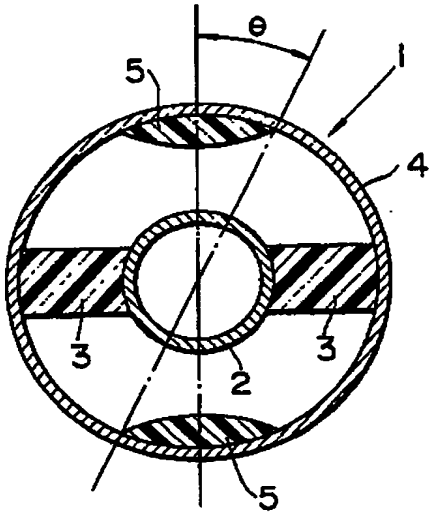


FIG.2

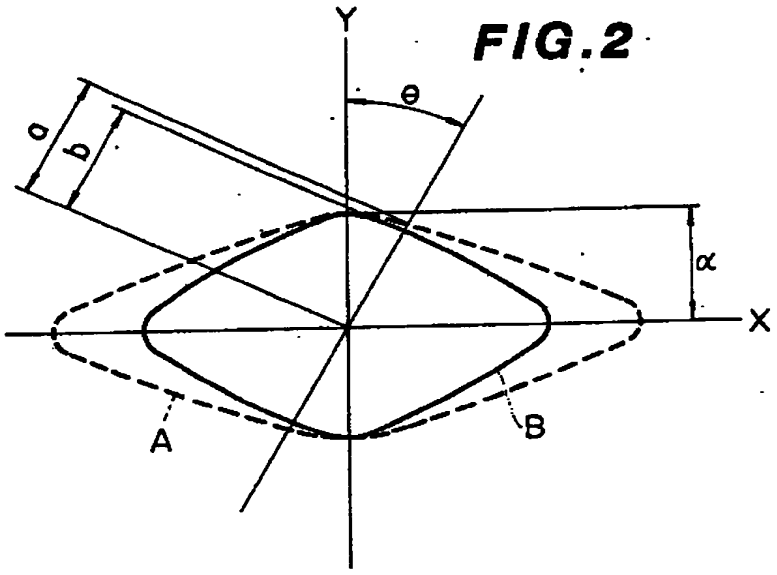


FIG.3

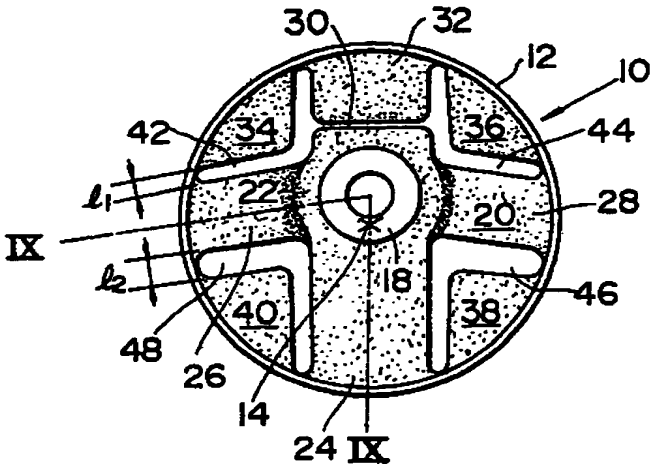
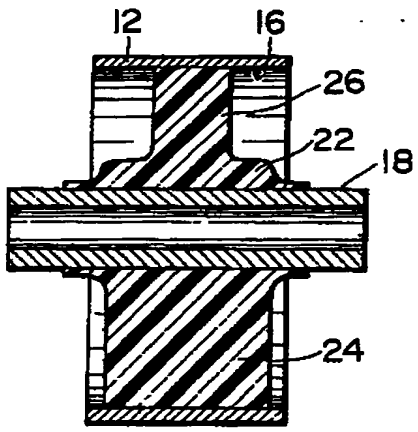

30
32
12
10
42
34
36
44
l_1
22
20
28
IX
l_2
18
46
40
38
48
26
14
24
IX

FIG.4


12
16
26
22
18
24